Installation and Operations Manual

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RAMONA TECHNOLOGY
17849 HIGHWAY 67
RAMONA, CA 92065
WWW.RAMONATECH.COM

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Introduction

Congratulations on your purchase of your new GOII system for the Losmandy G-8 (or G-11) or Celestron CI 700 Equatorial telescope Mount.

Before starting the installation, verify the condition of the all equipment for signs of damage. If damage exists contact the shipping company.

Inventory the shipment. If anything is missing contact Ramona Technology.

Caution: Please read Chapter 1 or 2 " Installation" completely, Before Proceeding with the Installation

Safety Instructions

Safety instructions for setting up and using your new system are given throughout this manual.

Abbreviations, Acronyms, and Astronomy Terms

Abbreviations, acronyms, and astronomy terms are identified or defined as they are used in this manual. For a complete listing refer to the Glossary

Notational Conventions

CAUTION: A CAUTION indicates either potential damage to personnel or equipment and tells you how to avoid the problem

Chapter 1

Installation - Losmandy telescope mount

The following step-by-step procedure will convert your existing Losmandy telescope to a complete stand-alone GoII system. No permanent modifications to the original mount are required and the mount can be converted back to the original Losmandy configuration at any time. All special tools (Allen head hex wrenches) not normally found in the average home shop and required for this installation are provided. The installation is the same for the either the G8 and G11 mounts.

Step 1:
Disconnect all cables and power from the Losmandy controller.

DEC Motor Installation

Fig 1 shows an unmodified G8 mount. In the next series of steps the DEC and RA motors will be removed and replaced with the ones supplied with your GoII system. The procedure is identical for either the G8 or G11 mount and is the same for the RA and DEC motors

Fig. 1

Step 2:
With reference to Figures 1 and 2 remove the plastic (or optional aluminum) motor cover.

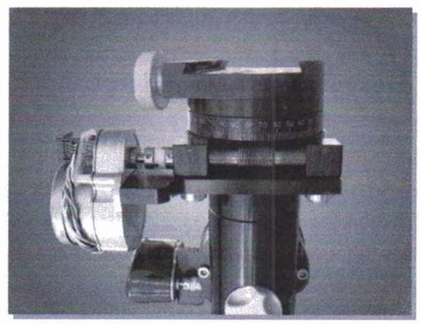
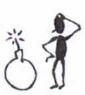


Fig. 2

Step 3:
To remove the existing Losmandy DEC motor from the mount, remove the two #6/32 button head screws using the 7/64" Allen wrench. In Fig 2 the worm gear cover has been removed to show the coupler.



Caution: Do not remove the worm cover as this could expose the gears to possible damage.

The motor and worm gear are attached with self-aligning coupler. Gently pull on the motor. The coupler will split apart. The plastic piece may stay with the motor or mount.

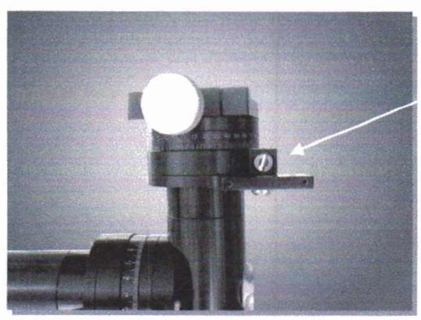


Fig. 3

Step 4:
Remove the coupler from the motor shaft using the 0.05" Allen wrench. Set the coupler aside, it will be used in Step 5 below. Fig 3

shows the G8 mount with DEC motor removed. Note the portion of the of the coupler still attached to the worm shaft.

Shaft Coupler

Coupler Interface Shown Slid partially off

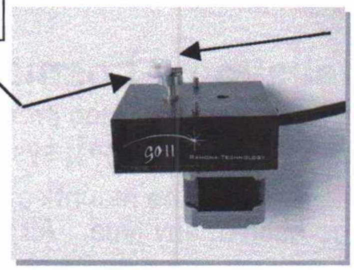


Fig 4

Step 5:
Refer to Fig 4 for the following. The plastic coupler interface is symmetrical and either side can be installed on the motor/gearbox. Install coupler (removed at step 2) on the new DEC Motor/Gearbox
<u>*Note: the DEC Motor/Gear Box is the one with the long cable.*</u>
Make sure the setscrews line up with the flats on motor shaft. The coupler should be pressed on the shaft as far as it will go. Tighten both setscrews

Step 6:
If the Plastic piece came out with the motor make sure it is centered on the coupler.
Step 7:
Refer to Fig 5, Insert 2ea #6-32 x 1 ¼ long Allen head screws through the gearbox from the motor side.

Mounting Screws

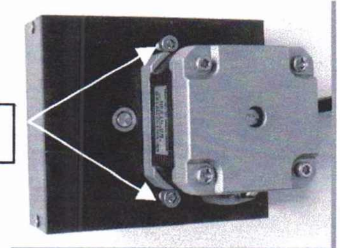


Fig 5

Rotate the shaft to align the slot in the plastic coupler with rod on the coupler section on the mount. Push the motor/gearbox on the mount and tighten the 2 screws using the Allen wrench provided.
Fig 6. Shows the DEC motor/gearbox attached to the mount. The worm cover has been removed to show how the coupler should look.

Caution: Do not remove the worm cover as this could expose the gears to possible damage.

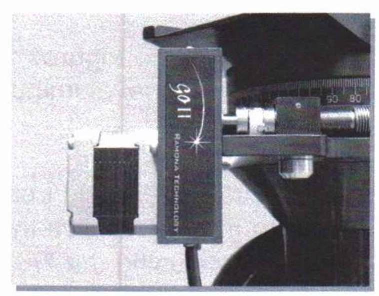


Fig 6

RA Motor Installation

Step 8:
Repeat steps 2 through 7 except for RA Motor. Fig 7 shows the RA motor properly attached to the G11 mount.

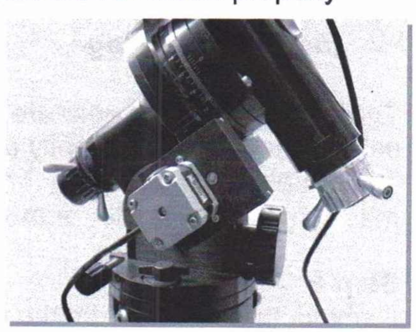


Fig 7

Dovetail Knob Installation

Step 9:
If a telescope is installed on the mount remove it before proceeding.

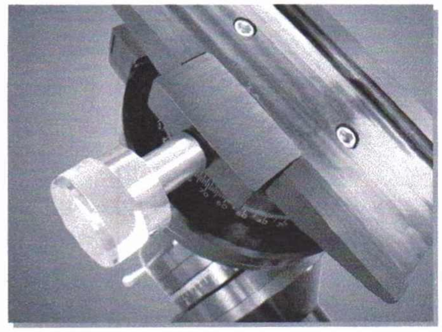


Fig 8

The Losmandy Dovetail knob will not clear the DEC gearbox and must be replaced. The knob supplied is made up of two pieces. This was done so that the gripping surface is large enough to be able to tighten the dovetail easily. Remove the Losmandy knob and replace with the one supplied as shown in Fig 8.

Caution: In using the new knob the large section must be removed after tightening the telescope in the dovetail, and before the telescope is moved to avoid possible damage. See Fig 9.

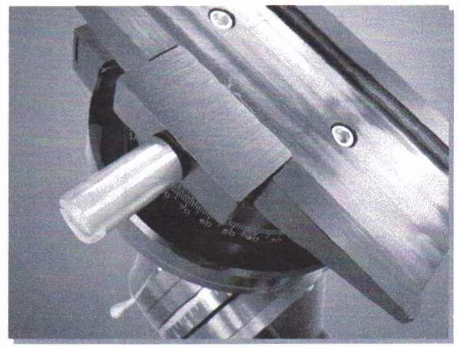


Fig 9

Digital Controller Installation

Step 10:
With reference to Fig 5, install the digital controller using the hand screws removed during step 1. Adjust the angle of the controller as desired. Tighten one of the hand screws so that the controller is snugged tightly to the mounting bracket. Then tighten the other hand screw.

Step 11:
Connect RA and DEC Motor cables to the controller.

Caution: Dress and tie cables so that they do not interfere with the mount as it is rotated throughout the entire range

Hand Controller Installation

Step 12:
If the wireless option has be purchased, Install 2 AA batteries (supplied)

Caution: To prolong the life of the batteries, they should be removed when the controller is turned off or stored

Step13:
If desired the hand controller can be attached to either side of the goII controller or to the Losmandy mount with Velcro strips (supplied)

Even if the system is to be operated in the wireless mode connect the hand controller to the digital controller using the 6-conductor cable supplied.

Chapter 2

Installation - Celestron CI 700 telescope mount

The following step-by-step procedure will convert your existing CI 700 telescope to a complete stand-alone GOII system. No permanent modifications to the original mount are required and the mount can be converted back to the original Celestron configuration at any time. All special tools (Allen head hex wrenches) not normally found in the average home shop and required for this installation are provided.

Step 1:
Disconnect all cables and power from the Celestron controller.

DEC Motor Installation

Fig 10 shows an unmodified CI 700 mount. In the next series of steps the DEC and RA motors will be removed and replaced with the ones supplied with your GOII system. The procedure is identical for both the RA and DEC motors

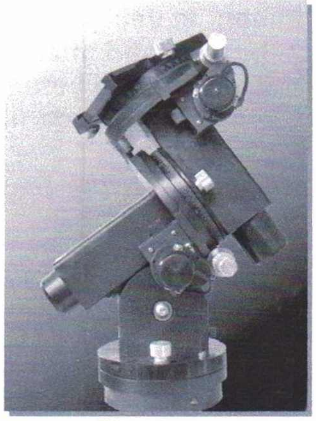


Fig 10

Step 2:
To remove the existing Celestron DEC motor from the mount, Insert the 7/64" Allen head hex wrench in the lower slots as shown in Fig 11. Find the Allen head cap screws with the wrench. Hold the drive motor with one hand and remove the two #6/32 Cap head screws using the 7/64" Allen wrench. The whole assembly will come away from the mount. Note: the screws and washers may be removed from the gearbox by shaking the gear in the vertical position.

Fig 11

Step 3:
Fig 12 shows the Ramona Technology motor-gearbox and mounting screws. Except for the cable length the units are identical. The declination drive is the one with longest cable.

To install the new motor, place washers on each of the 2 ¼" long 6-32 cap head screws. Insert one of the screws through the gearbox as shown in Fig 12.

With reference to Fig 13, Locate the 2 threaded holes in the underside of the dec plate. Position the gearbox so that the screw can be inserted in the hole closest to the worm gear. Turn the screw till there is approximately 1/32" between the gearbox and bottom of the dec plate. Insert the second screw in the rear hole and turn the screw until it is inserted as far as the first screw. Now slide the gearbox away from the worm as far as it will go. Align the output gear on the gearbox with the gear on the worm shaft. Snug up both screws so that gearbox can be held in position but still be

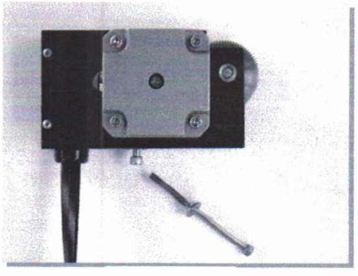


Fig 12

slid on the dec plate. Slide the gearbox toward the worm until the output gear on the gearbox and the gear on the worm shaft engage. You may have to turn the knob on the worm shaft for them to line up. There should be a small amount of backlash so the gears do not bind. Tighten up both screws. To check the backlash turn the knob on the worm shaft back and forth. There should be a perceptible movement in the gear on the worm shaft before the gear on the gearbox starts to rotate.

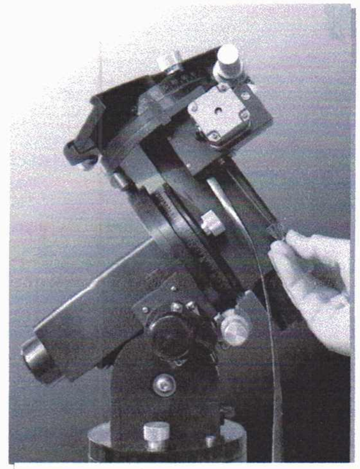


Fig 13

RA Motor Installation

Step 4:

Repeat steps 2 through 7 except for RA Motor. Fig 14 shows both motors properly attached to the CI-700 mount.

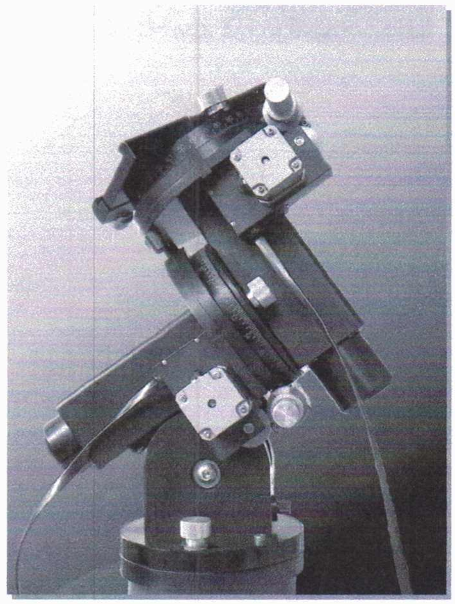


Fig 14

Digital Controller Installation

Step 5:

With reference to Fig 15, using a No.2 Phillips head screwdriver remove the 4 screws (in the corners) that hold the CI 700 Drive Controller in its enclosure. Using the screws just removed, attach the Ramona Controller mounting bracket as shown in Fig 16. With reference to Fig 17 install the GoII digital controller on the mounting bracket with the 2 knobs supplied. Adjust the angle of the controller as desired. Tighten both of the hand screws so that the controller is snugged tightly to the mounting bracket.

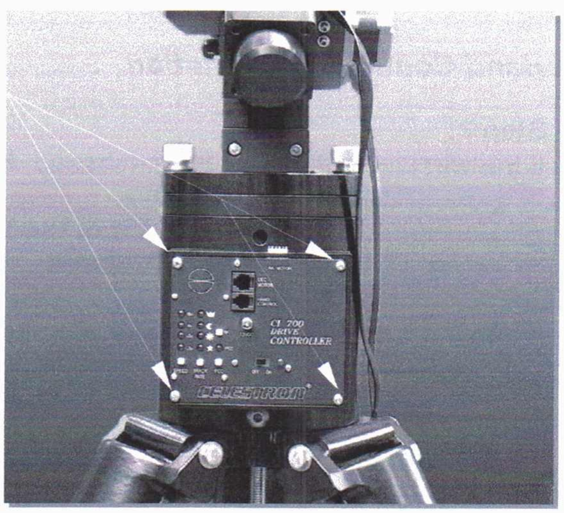


Fig 15

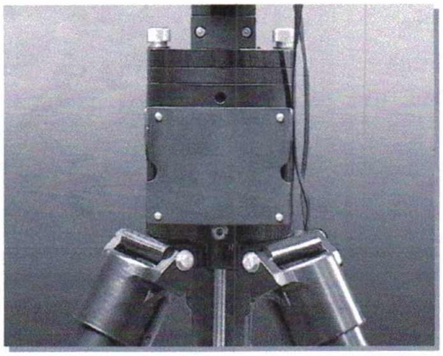


Fig 16

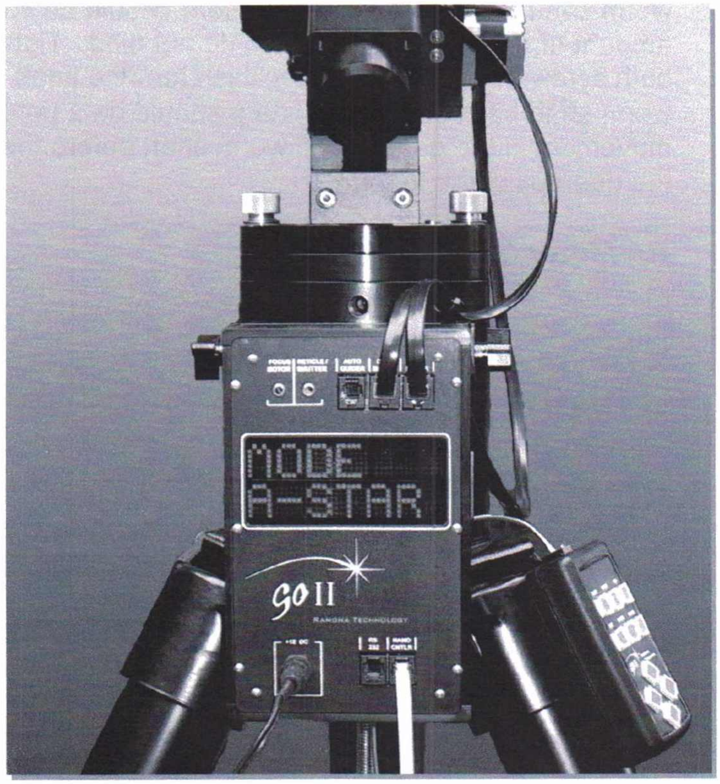


Fig 17

Step 6:
Connect RA and DEC Motor cables to the controller.

Caution: Dress and tie cables so that they do not interfere with the mount as it is rotated throughout the entire range

Hand Controller Installation

Step 7:
If the wireless option has be purchased, Install 2 AA batteries (supplied)

Caution: To prolong the life of the batteries, they should be removed when the controller is turned off or stored

Step 8:
If desired the hand controller can be attached to either side of the goII controller or to the Celestron mount with Velcro strips (supplied)

Even if the system is to be operated in the wireless mode connect the hand controller to the digital controller using the 6-conductor cable supplied.

Initial Operation and Checkout

Step 9:
If a telescope is installed on the mount make sure it is well balanced. Make sure the mount is not set near the end of any travel range.

Initial checkout should be done with the AC power supply provided even if the system will be operated from a battery or other power source. Make sure the power supply is disconnected from the AC source. Connect the power supply to the goII controller.

Caution: Make sure there is sufficient clearance around mount because when the power supply is plugged into the AC source the system will start operating automatically. There is no ON/OFF switch in the system.

Warning: Never Never Plug or Un-plug the RA or DEC motors with power applied to the system. Damage to the controller will occur!!

Step 10:
Connect the power supply to the AC source and observe the following:

1. The RA motor should be "tracking"
2. The goII controller should display the sign-on message
3. All the hand controller pushbuttons should be illuminated

Step 11:
Depress the "MODE" push button on the hand controller and observe that the display shows the word "MODE"

Step 13:
With one hand depress the "SLEW" pushbutton. With the other hand depress the "NORTH" push button and verify the Declination ramps up and slews in the proper direction

Step 14:
With one hand depress the "SLEW" pushbutton. With the other hand depress the "SOUTH" push button and verify the Declination ramps up and slews in the opposite direction

Step 15:
With one hand depress the "SLEW" pushbutton. With the other hand depress the "EAST" push button and verify the RA motor ramps up and slews in the proper direction

Step 16:
With one hand depress the "SLEW" pushbutton. With the other hand depress the "WEST" push button and verify the RA ramps up and slews in the opposite direction

Step 17:
Unplug the AC power supply

Chapter 3

System Operation

After the GoII system is installed and power is turned on one of two things happens:

1) If the hand controller is not connected to the digital controller by cable, the system remains in the boot loader waiting for commands from a PC to update the firmware. The controller will stay in this mode for 10 seconds. Instructions to upgrade firmware are explained in *Chapter 5 -Maintenance*.
2) If the hand controller is connected to the GoII controller by cable, the system will boot up and become ready for normal operation

If wireless hand controller is installed, the cable may now be disconnected and the system will operate in the wireless mode. Operation is identical in the cabled and wireless modes.

The system operation will be explained using a series of menu trees. The tree shows graphically a sequence of button pushes and the resulting display information.

Display abbreviations are expanded in the glossary in *Chapter 9*.

There are two main sections of the menu tree. The first is the **SETUP** section, where all parameters and operating modes are entered. All parameters in this section are stored in non-volatile memory. When power to the controller is removed and restored the parameters previously entered are used.

There is one command that does not fit into the normal menu tree. It is explained as follows:

To increase/decrease the brightness of the buttons on the hand controller, with the left hand simultaneously depress the SLEW and SET buttons. With the right hand depress the UP or DOWN button.

In the menu tree the two-line display is shown in bold outline. The push button operation is shown in normal outline. The sequence of operation and corresponding display, flows from left to right and top to bottom.

Three steps for successful operation of the GoII system.

1. Polar alignment – The GoII system assumes that the user has performed an accurate Polar alignment of the mount. Accurate pointing and tracking of all objects and RA/DEC references requires this. See Chapter 4 (**Making the telescope's axis of rotation parallel to the Earth's**) for information on how to polar align your system.

2. Initial SETUP parameters – The user must initialize the information in the SETUP menu. This includes TIME, MONTH, DATE, YEAR, UT-OFFSET, LATATUDE, LONGITUDE, DISPLAY BRIGHTNESS, RETICLE BRIGHTNESS, FOCUS SPEED, SCROLL SPEED, SLEW SPEED, TSCOPE, DECBAK, and RABAK. See the section on (**Mode Descriptions**) for information on how to use the SETUP mode.

3. Initial alignment of either a bright star or an object. This is accomplished using the A-STAR mode for bright stars or CATLOG for NGC, IC, Planets or Messier objects.

Command Descriptions

Slew

Pressing the SLEW button along with a direction button (NORTH, SOUTH, EAST, WEST) will **slew** the telescope in the direction desired. Also note that the display will update both RA and DEC to reflect the current position, this assumes the telescope was previously ALIGNED.

Set

Pressing the SET button along with a direction button (NORTH, SOUTH, EAST, WEST) will move the telescope at 10x the Sidereal rate in the direction desired. This mode is intended for **centering** an object in the eyepiece or in the field of view of a CCD or film camera

Guide

Pressing one of the direction buttons (NORTH, SOUTH, EAST, WEST) will move the telescope at 0.5x the Sidereal rate in the direction desired. This mode is intended for **guiding** an object in the eyepiece or in the field of view of a CCD or film camera

Displaying Local Time

Pressing the EAST button along with the WEST button, displays the current local time. This will be displayed until a direction or Mode button is pressed.

Displaying Local Sidereal Time

Pressing the NORTH button along with the SOUTH button, displays the current local sidereal time. This will be displayed until a direction or Mode button is pressed.

Quick Align

Pressing the SET button along with the ENTER button, will place the controller in the ALIGN mode. This facilitates in aligning the telescope to an object or a previously entered RA/DEC position.

Focus Near/Far

Pressing the SLEW button along with either the UP or DOWN button, will focus (near or far) the eyepiece if an appropriate focus motor is connected to the controller.

LAG = N 32°50' − 116°27' W

Home: [illegible] −117°12'

Palomar 33°21' −116°53

LBV 33°02 −116°23

PST: −8 HRS

DST: −7 HRS

Mode Descriptions

CATLOG (Catalog)

This mode allows the user to select an object from the built-in database. There are 4 catalogs in the database. NG (contains all objects in the NGC catalog of John Dreyer published in 1888) M (contains all the objects in the lists of Charles Messier) IC the "Indexed Catalog" and P (8 Planets excluding earth). After the object is selected pressing the ENTER button will display relevant information about the selected object. Pressing the ENTER button again re-displays the objects information. Pressing the UP/DOWN button while in this mode will display the next/previous object. After selecting the object the controller will prompt the user (by flashing bright/dim) the RA/DEC to be selected. Pressing the ENTER button sets this object as the next object to GOTO or ALIGN to.

ALIGN

This mode *aligns* the telescope to an object or RA/DEC that was previously selected or, *aligns* a selected object that was centered using the SLEW commands. After the object is selected, the controller will prompt the user (by flashing bright/dim) the RA/DEC to be *aligned.* Pressing the ENTER button sets this object as the current aligned position RA/DEC.

A-STAR (Align Star)

This mode allows the user to select from a list of approximately 25 bright stars (+1 mag and brighter) to facilitate aligning the telescope. After the star is selected, the controller will prompt the user (by flashing bright/dim) the RA/DEC of the selected star. Pressing the ENTER button selects the star RA/DEC as the current position.

RATE

This mode selects the tracking rate of the telescope. The rate options are Sidereal, Solar, Lunar, and King. Pressing the ENTER button selects the displayed rate.

PEC (Periodic Error Correction)

This mode selects one of three modes for Periodic Error Correction, These modes are, RECORD, ON, and OFF. When the RECORD mode is selected the controller will record any guide corrections entered on the hand controller. While in this mode, 'RECORD' will flash in the display for one revolution of the worm, (4-min. for a 360-tooth worm gear) then the PEC mode will switch to ON. In the ON mode the controller will *playback* the corrections that were input during the RECORD mode. Selecting OFF deactivates the PEC mode. (See PEC description later in this chapter).

ENTER

This mode allows the user to enter a specific RA/DEC directly. This input will be used for a subsequent ALIGN or GOTO command.

GOTO

This mode slews the telescope to the object or RA/DEC that was previously selected. After the command is selected with the ENTER button, the controller will prompt the user (by flashing bright/dim) the RA/DEC. Pressing the ENTER button while RA/DEC is flashing starts the telescope slewing. Pressing the SLEW button while the telescope is moving will halt movement. Entering the GOTO mode again will cause the telescope to continue to the selected object or RA/DEC.

NOTE: Pressing any motion button (SLEW, SET, NORTH, SOUTH, EAST, WEST) will escape from ANY mode.

Mode Descriptions (cont.)

SETUP

This mode allows the user to enter specific values for the operation of the controller. The following parameters are stored in battery backed-up memory, allowing these values to be re-loaded the next time the controller is powered up.

TIME, MONTH, DAY, YEAR Current Time, Month, Day, Year
This information is required for the correct operation of the system. It is used for setting the telescope limits as well a calculating the Planet positions.

UT-OFF Universal Time Offset from GMT
The Universal time offset is used to calculate the local sidereal time. The local sidereal time is used for performing the meridian flip of the mount.

LAT Your Site Latitude (±DD.dd degrees, tenths of deg)
LONG Your Site Longitude (±DDD.d degrees, tenths of deg)
These values are used for checking the horizon limits and calculating local sidereal time

DISBRI LED Display Brightness (0 – 9)
RETBRI Illumined Reticle Brightness (0 – 9)
FOCSPD Focus Motor Speed (0 – 9)
SCRSPD Display Scroll Speed (0 – 9)
These values are user configurable for setting preferences.

SLWSPD Slew Speed (30 – 70)
This value sets the motor maximum slew speed. A slower speed might be required for a mount that is heavily loaded or un-balanced.

TSCOPE Telescope Type (0 – 3)
This entry selects the current mount that is being used. This is used for calculating the PEC and tracking rates.

0 = Losmandy G-11
1 = Losmandy GM-8 Mount
2 = Celestron CI700 mount
3 = Reserved for future use

DECBAK DEC Backlash Reduction (0 – 99)
RABAK RA Backlash Reduction (0 – 99)
These two values are available to the user for Telescope types 2 and above. These values can be adjusted the remove the gear-train backlash that exists. Adjustment is performed while looking through an eyepiece while alternately pressing the **SET** button along with a direction button (**N,S,E,W**) and adjusting the backlash value until the motor delay is removed.

NOTE: Pressing any motion button (SLEW, SET, NORTH, SOUTH, EAST, WEST) will escape from ANY mode.

The table on the following pages shows the system control flow in tabular form. The contents of the display are outlined in bold. A light line outlines push button action. The menu flows from left to right with the ENTER key and up/down with the UP/DOWN keys

LED Display Information

Flashing Bright/Dim

The flashing bright/dim of RA/DEC alerts the user to choice between two options.

1. Pressing 'ENTER' - In the ALIGN, A-STAR, ENTER modes, pressing the 'ENTER' button sets the displayed RA/DEC as the current location.

2. Pressing any motion button – Exits the current mode.

Menu Tree

Menu Tree

Button	Display	Button	Display	Button	Display	Button	Display	Button	Display	Description
MODE	**MODE** *any*									**Setup Mode**
		UP/ DOWN	**MODE SETUP**							
				ENTER	**SETUP** *any*	UP/ DOWN	**SETUP TIME**			Enter Local Time of Day
						UP/ DOWN	**SETUP MONTH**			Enter Current Month (number)
						UP/ DOWN	**SETUP DAY**			Enter Current Day (number)
						UP/ DOWN	**SETUP YEAR**			Enter Current Year (number)
						UP/ DOWN	**SETUP UT-OFF**			Enter the Offset (hours) from Universal Coordinated Time
						UP/ DOWN	**SETUP LAT**			Enter Local Latitude
						UP/ DOWN	**SETUP LONG**			Enter Local Longitude
						UP/ DOWN	**SETUP DISBRI**			Enter Display Brightness
						UP/ DOWN	**SETUP RETBRI**			Enter Reticle Brightness
						UP/ DOWN	**SETUP FOCSPD**			Enter Focus Speed
						UP/ DOWN	**SETUP SCRSPD**			Enter Display Scroll Speed
						UP/ DOWN	**SETUP SLWSPD**			Enter Motor Slew Speed
MODE	**MODE** *any*									**Enter Mode**
		UP/ DOWN	**MODE ENTER**							
				ENTER	**MV RA 0000.0**					Enter RA and DEC to which the Scope is to be moved
						ENTER	**MV DEC +0099**			
MODE	**MODE** *any*									**GO TO Mode**
		UP/ DOWN	**MODE GO TO**							
				ENTER	**0000.0 +00.00**					Start movement to selected RA and DEC
MODE	**MODE** *any*									**Catalog Mode**
		UP/ DOWN	**MODE CATLOG**							
				ENTER	**CATLOG** *any*					
						UP/ DOWN	**CATLOG NG0000**			To find an object in the data base
						UP/ DOWN	**CATLOG M000**			
						UP/ DOWN	**CATLOG IC0000**			
								ENTER	*object scroll*	

Menu Tree (cont.)

Menu Tree

Button	Display	Button	Display	Button	Display	Button	Display	Button	Display	Description
MODE	**MODE** *any*									**Align Mode**
		UP/ DOWN	**MODE ALIGN**							
				ENTER	**ALIGN** *object*					Align to an Object or an RA/DEC
						1 Sec Delay	**0000.0 +00.00**			
								ENTER	**ALIGN DONE**	
MODE	**MODE** *any*									**A-Star Mode**
		UP/ DOWN	**MODE A-STAR**							
				ENTER	**A-STAR** *any*					Align to a selected bright star
						UP/ DOWN	**A-STAR** *starname*	*continue on next line*		
	a-star continued	ENTER	**A-STAR** *object*							
				1 Sec Delay	**0000.0 +00.00**					
						ENTER	**A-STAR DONE**			
MODE	**MODE** *any*									**Rate Mode**
		UP/ DOWN	**MODE RATE**							
				ENTER	**RATE** *current rate*					
						UP/ DOWN	**RATE SIDREL**			Select a guide Rate
						UP/ DOWN	**RATE SOLAR**			
						UP/ DOWN	**RATE LUNAR**			
						UP/ DOWN	**RATE KING**			
								ENTER	**RATE DONE**	
MODE	**MODE** *any*									**PEC Mode**
		UP/ DOWN	**MODE PEC**							
				ENTER	**PEC** *current pec*					
						UP/ DOWN	**PEC RECORD**			Select a PEC mode
						UP/ DOWN	**PEC ON**			
						UP/ DOWN	**PEC OFF**			
								ENTER	**PEC DONE**	

Chapter 4

Periodic Error Correction (PEC)

Periodic Error Correction, or PEC, is a system that improves the tracking accuracy of the drive. PEC is designed to improve photographic quality by reducing the amplitude of the worm gear errors. Periodic error is a slight oscillation in right ascension caused by imperfections in all drive gears. The cycle of the periodic error is equal to one rotation of the worm gear, which is four minutes for the G-11 and two minutes for the G-8 and CI-700. No matter how precise, all telescope drives will have *some* periodic error. Using the PEC function is a two-step process. First, you must guide for at least four minutes (two minutes for the G-8 and CI-700), keeping the guide star centered on the cross hairs of your guiding eyepiece, during which time the system records the correction you make. It takes the worm gear four minutes to make one complete revolution, hence the need to guide for four minutes. The second step is to play back the corrections you made during the recording phase. The microcomputer inside the electronic console does this automatically after one revolution of the worm gear. Keep in mind that this feature is for advanced astro-photographers and requires careful guiding. Here's how to use the PEC function most effectively.

1. Find a bright star relatively close to the object you want to photograph.
2. Insert a high power eyepiece with illuminated cross hairs into your telescope. Orient the guiding eyepiece cross hairs so that one is parallel to the declination axis while the other is parallel to the R.A. axis.
3. Center the guide star on the illuminated cross hairs, focus the telescope, and study the periodic movement.
4. Take a few minutes to practice guiding. This will help you familiarize yourself with the periodic error of the drive and the operation of the hand controller.
5. Enter the "PEC" mode and select 'RECORD' then press 'ENTER'. 'RECORD' will flash once a second for four minutes. For best results, the star should be centered on the cross hairs for a few seconds before activating the PEC - RECORD function.
6. Guide for two or four minutes depending on your telescope mount. Try not to overshoot corrections in right ascension. Ignore drift in declination.

After four/two minutes, the system will automatically switch to the PEC – ON mode to playback the corrections made during the first four minutes.

Once you have used the PEC function for a while you may mistake its operation for the way the drive normally operates. The best way to see how well the PEC function works is to turn if off and note the change in tracking. PEC results improve with practice and patience.

Adjusting the mount for polar alignment (Losmandy)

Note: Currently the system is designed to operate only in the Northern Hemisphere. A Future release of the firmware will allow the system to operate from the Southern Hemisphere.

In order for the clock drive to track accurately, the telescope's axis of rotation must be parallel to the Earth's axis of rotation, a process known as polar alignment. Polar alignment is achieved NOT by moving the telescope in R.A, or DEC, but by adjusting the mount vertically, which is called **altitude**, and horizontally, which is called **azimuth**. This section simply covers the correct movement of the telescope during the polar alignment process. The actual process of polar alignment, (***Making the telescope's axis of rotation parallel to the Earth's***) is described later in this manual in the section on Polar Alignment. To adjust the mount in altitude:

1. Locate the altitude adjustment knob - directly below the counterweight shaft.
2. Turn the altitude adjustment knob until the mount is at the right elevation. Each complete revolution of the knob raises or lowers the polar axis 3.2°.

The altitude range is from 14° to 64°. If you live at latitudes closer to the poles, you will need the Zero Degree Latitude Adapter which is sold as an optional accessory by Losmandy and increases the latitude range from 0° to 84°. To adjust the mount in azimuth:

1. Locate the azimuth lock screws and adjustment knobs on the back of the mount.
2. Loosen the two azimuth lock screws on each side of the mount.
3. Turn either of the azimuth adjustment knobs until the polar axis is pointing in the right direction. Each complete revolution of the knob is .82°.
4. Tighten the azimuth lock screws to hold the mount in place.

The mount can be moved ± 8.5° in azimuth using these knobs. Keep in mind that adjusting the mount is done during the polar alignment process only. **Once polar aligned, the mount must NOT be moved**. Pointing the telescope is done by moving the mount in right ascension and declination. Once the appropriate adjustments have been made and telescope is aligned on the celestial pole, apply power to the controller and the telescope will track.

Making the telescope's axis of rotation parallel to the Earth's

Polar aligning your G-8/G-11 or CI 700Mount

In order for the telescope to track the stars, you must meet two criteria; first, you need a drive motor that moves at the same rate as the stars. A polar axis finder is offered as an optional accessory. The second thing you need is to set the telescope's axis of rotation so that it tracks in the right direction. Since the motion of the stars across the sky is caused by the Earth's rotation about its axis, the telescope's axis must be made parallel to the Earth's. The polar axis is the axis around which the telescope rotates when moved in right ascension. This axis points in the same direction even when the telescope moves in right ascension.

Polar alignment is the process by which the telescope's axis of rotation (called the polar axis) is made parallel with the Earth's axis of rotation. Once aligned, a telescope with a GOII system will track the stars as they move across the sky. The result is that objects observed through the telescope appear stationary. They will not drift out of the field of view because the motors and gears exactly compensate for the motion caused by the Earth's rotation. Even if you are not using the clock drive, polar alignment is still desirable since it will reduce the number of corrections needed to follow an object and limit all corrections to R.A. axis. There are several methods of polar alignment, all of which work on a similar principal, but perform somewhat differently. Each method will be considered separately, beginning with the easier methods and working to the more difficult.

Although there are several methods mentioned here, you will never use all of them during one particular observing session. Instead, you may use only one if it is a casual observing session. Or, you may use two methods, one for rough alignment followed by a more accurate method if you plan on doing astro-photography.

Where are the Poles?

In each hemisphere, there is a point in the sky around which all the other stars appear to rotate. These points are called the **celestial poles** and are named for the hemisphere in which they reside. For example, in the Northern Hemisphere all stars move around the North Celestial Pole. When a telescope's polar axis is pointed at the celestial pole, it is parallel to the Earth's rotational axis. The North Celestial Pole is the point in the Northern Hemisphere around which all stars appear to rotate. The counterpart in the Southern Hemisphere is referred to as the South Celestial Pole.

Many of the methods of polar alignment require that you know how to find the celestial pole by identifying stars in the area. For those in the Northern Hemisphere, finding the celestial pole is not too difficult. Fortunately, we have a naked eye star less than a degree away. This star, Polaris, is the end star in the handle of the Little Dipper. Since the Little Dipper (technically called Ursa Minor) is not one of the brightest constellations in the sky, it may be difficult to locate from urban areas. If this is the case, use the two end stars in the bowl of the Big Dipper (the pointer stars). Draw an imaginary line (away from the "pan") through them toward the Little Dipper. They point almost directly to Polaris. Since the position of the Big Dipper rotates throughout the night as well as during the year it may be difficult to locate, or even perhaps be below the horizon
Observers in the Southern Hemisphere are not as fortunate as those in the Northern Hemisphere. The stars around the south celestial pole are not nearly as bright as those around the North Celestial Pole. The closest star that is relatively bright is Sigma Octantis. This star is just within the naked eye limit (magnitude E.5) and lies about 59 arc minutes from the pole. For more information about stars around the south celestial pole, please consult a star atlas.

Latitude Scales

The easiest way to polar align a telescope is with a latitude scale. Unlike other methods that require you to find the celestial pole by identifying certain stars near it, this method works off of a known constant to determine how high the polar axis should be pointed. The Losmandy G-11 mount can be adjusted from 14° to 64°.

The constant, mentioned above, is a relationship between your latitude and the angular distance the celestial pole is above the northern (or southern) horizon. The angular distance from the northern horizon to the North Celestial Pole is always equal to your latitude. To illustrate this, imagine that you are standing on the North Pole, latitude +90°. The North Celestial Pole, which has a declination of +90°, would be directly overhead (90° above the horizon). Now, let's say that you move 1° south. Your latitude is now +89° and the celestial pole is no longer directly overhead. It has moved 1° closer toward the northern horizon. This means the pole is now 89° above the northern horizon. If you move 1° further south, the same thing happens again. As you can see from this example, the distance from the northern horizon to the celestial pole is always equal to your latitude.

If you are observing from San Diego, which has a latitude of 32°57', then the celestial pole is 32°57' above the northern horizon. All a latitude scale does then is to point the polar axis of the telescope at the right elevation above the northern (or southern) horizon. To polar align your telescope:

1. Make sure the polar axis of the mount is pointing due north. Use a landmark that you know faces north.
2. Level the tripod. There is a bubble level built into the mount for this purpose. Please note that leveling the tripod is only necessary if using this method of polar alignment. Perfect polar alignment is still possible using other methods described later without leveling the tripod.
3. Adjust the mount in altitude until the latitude indicator points to your latitude. Moving the mount affects the angle the polar axis is pointing. For specific information on adjusting the equatorial mount, please see the section Adjusting the Mount.

This method can be done in daylight, thus eliminating the need to fumble around in the dark. Although this method does NOT put you directly on the pole, it will limit the number of corrections you will make when tracking an object. It will also be accurate enough for short exposure prime focus planetary photography (a couple of seconds) and short exposure piggyback astro-photography (a couple of minutes).

Pointing at Polaris

This method utilizes Polaris to polar align your mount. Since Polaris is less than 1° from the North Celestial Pole, you can simply point the polar axis of your telescope at Polaris. Although this is by no means perfect alignment, it does get you within 1°. Unlike the previous method, this must be done in the dark when Polaris is visible.

1. Set the telescope up so that the polar axis is pointing north.
2. Loosen the DEC clutch knob and move the telescope so that the tube is parallel to the polar axis. When this is done, the declination setting circle will read +90°. If the declination setting circle is not aligned, move the telescope so that the tube is parallel to the polar axis.
3. Adjust the mount in altitude and/or azimuth until Polaris is in the field of view of the finder.
4. Center Polaris in the field of the telescope using the fine adjustment controls on the wedge.

Remember, while polar aligning, do NOT move the telescope in R.A. or DEC. You do not want to move the telescope itself, but the polar axis. The telescope is used simply to see where the polar axis is pointing.
Like the previous method, this gets you close to the pole but not directly on it. The following methods help improve your accuracy for more serious observations and photography.

The Polar Axis Finder

The Polar Axis Finder is designed to minimize polar alignment set-up time while maintaining maximum accuracy. The installation of this optional accessory is described in the section on Installing the Polar Axis Finder. Here's how to use it:

1. Turn the Polar Axis Finder illuminator on.
2. Place Polaris in the field of the polar axis finder by adjusting the mount in altitude and azimuth.
3. Rotate the polar scope until the orientation of the stars on the reticle matches the star pattern in the sky (as seen with the naked eye).
4. Adjust the mount in altitude and azimuth until Polaris is in the small space on the line between Eta h Ursa Major (Alkaid - at the end of the *handle* of the Big Dipper) and Epsilon e Cassiopeia (Segin - the beginning of the *W*).
5. Note the second brightest star in the field.
6. Place this star in space on the line between Cassiopeia and the bowl of the Big Dipper. If you can not get Polaris and this second star in their respective places, rotate the polar axis finder until you can.

When finished, the mount is accurately polar aligned.

Declination Drift

This method of polar alignment allows you to get the most accurate alignment on the celestial pole and is required if you want to do long exposure deep-sky astro-photography through the telescope. The declination drift method requires that you monitor the drift of selected guide stars. The drift of each guide star tells you how far away the polar axis is pointing from the true celestial pole and in what direction. Although declination drift is quite simple and straightforward, it requires a great deal of time and patience to complete when first attempted. The declination drift method should be done after any one of the previously mentioned methods has been completed. To perform the declination drift method you need to choose two bright stars. One should be near the eastern horizon and one due south near the meridian. Both stars should be near the celestial equator (0° declination). You will monitor the drift of each star one at a time and in declination only. While monitoring a star on the meridian, any misalignment in the east-west direction will be revealed. While monitoring a star near the east/west horizon, any misalignment in the north-south direction will be revealed. As for hardware, you will need an illuminated reticle ocular to help you recognize any drift. For very close alignment, a Barlow lens is also recommended since it increases the magnification and reveals any drift faster.

When looking due south with the scope on the side of the mount, insert the diagonal so it points straight up. Insert the cross hair ocular and align cross hairs to be parallel to declination and right ascension motion Use ±16x guide setting to check parallel alignment.
First choose your star near where the celestial equator and the meridian meet. The star should be approximately ± 1/2 hour of the meridian and ±5° of the celestial equator. Center the star in the field of your telescope and monitor the drift in declination.

- If the star drifts south, the polar axis is too far east.
- If the star drifts north, the polar axis is too far west.

Make the appropriate adjustments to the polar axis to eliminate any drift. One you have managed to eliminate all drift, move to the star near the east horizon. The star should be 20° above the horizon and ± 5° of the celestial equator.

- If the star drifts south, the polar axis is too low
- If the star drifts north, the polar axis is too high.

Once again, make the appropriate adjustments to the polar axis to eliminate any drift. Unfortunately, the latter adjustments interact with adjustments ever so slightly. Therefore, repeat the process again to improve the accuracy checking both axes for minimal drift. Once the drift has been eliminated, the telescope is very accurately aligned. You will be able to do prime focus deep-sky astro-photography for long periods.

NOTE: If the eastern horizon is blocked, you may choose a star near the western horizon however, you will have to reverse the polar high/low error directions. If using this method in the Southern Hemisphere, the procedure is the same as described above. However, the direction of drift is reversed.

A brief explanation of time

To simplify matters, nations have generally agreed to employ, on an earth wide basis, only 24 varieties of time, differing by whole hours from one another. We subdivide the 360 degrees of longitude around the equator into 24 intervals of 15 degrees, one for each hour. Thus the ZERO MERIDIAN, the meridian of Greenwich, is centered on one of these 15-degree strips. Within each segment of the earth, time remains constant; across the boundary of the neighboring 15 degree segment, time shifts by one hour, and so on, in orderly progression. A glance at a map of standard time zones, however, shows that the boundaries actually adopted are often quite irregular, to suit the convenience of individual communities. Eastern Standard Time is 5 hours earlier than Greenwich Standard Time, Central Standard Time, 6 hours earlier, Mountain Standard 7, Pacific Standard 8, and so on. These figures, which represent the difference between Greenwich Standard Time and your own standard time, we shall refer to as Standard Longitude Difference, abbreviated as SLD.

Greenwich Mean Time (GMT)

Which is also called Greenwich Standard Time, Greenwich Civil Time and Universal Time (UT), is the basic reference time used for most astronomical work. To avoid the cumbersome A.M. and P.M., astronomer's number the hours from 0 to 24, starting with midnight.

To derive GMT, add to your own Standard Mean Time (SMT) the number of whole hours corresponding to the Standard Longitude Difference (SLD): GMT = SMT + SLD. For example if you live in the zone of Central Standard Time. SLD = 6hours. If your SMT is 21h 32m, GMT = 21h 32m + 6h 00m = 27h 32m. Subtract 24 hours if necessary, in order to give a result in the normal range from 0 to 24: 27h 32m = 3h 32m. If you live east instead of west of Greenwich, the SLD is negative.

To calculate your Local Mean (solar) Time (LMT) the following formula is often useful:
LMT = SMT + SLD - LLD. Suppose you live in Cleveland Ohio, longitude 81 degrees 45min W. Divide by 15 to obtain the Local Longitude Difference of 5h 27m. Since Cleveland operates in the Eastern Standard Time, SLD = 5h. So, if the standard clock (Greenwich time) reads 3:49 PM (15h 49m), the Local Mean Time is:
LMT = (15h 49m) + (5h) - (5h 27m) = 15h 22m. If necessary, add or subtract 24 hours, as explained above.

Sidereal Time

The earth's revolution in its orbit causes the sun to drift eastward approximately 1 degree per day with respect to the stars. Thus, at the end of a year, when the earth has completed 365.2422 rotations with reference to the sun, it has made exactly 1 additional rotation, with reference to the stars; and so our year contains 366.2422 sidereal, or star, days. A Sidereal Day, in consequence, is about 4 minutes shorter than a solar day (24 hours divided by 366.2422).

On or about March 21, when the sidereal and solar years start, Sidereal "noon" (or zero hours sidereal time) occurs as solar noon (or about 12 hours on the solar clock). Hence the sidereal and solar clocks, whose time scales run consecutively from 0 hours to 23 hours 59 minutes, do not really coincide until 6 months later, at the autumnal equinox, on or about September 21. By this time the sidereal clock has gained 12 hours on the solar clock and both read midnight, or 0h 00m. The sidereal clock continues to gain on a mean time solar clock by 3m 56.555s of sidereal time for each solar day.

To calculate the sidereal time approximately, figure out the number of months and days that have elapsed since the autumnal equinox. Allow 2 hours for each month and 4 minutes for each day in excess of the months. Add this figure to the Greenwich Mean Time to get a rough estimate of the Greenwich Sidereal Time. For example, on May 29 at 17h 30m GMT, 8 months and 8 days after the autumnal equinox, figure as follows:

8 months at 2h per month	=	16h
8 days at 4m per day	=	0h 32m
GMT	=	17h 30m
Total	=	33h 62m

Subtract 24h to obtain the approximate Greenwich Sidereal Time:
GST = 10h 02m.

Sidereal time is the elapsed sidereal interval since the vernal equinox was last on the meridian. The equinox is the point on the celestial sphere where the sun crosses the equator in the spring. Sometime called the point of Aries. To obtain a more accurate value of the sidereal time at a given instant, corrections would have to be made for rotation and precession.

Chapter 5

Maintenance

Hardware

Replacing Hand Controller Batteries (wireless option)

Depress the battery cover latch (on the rear of the hand controller case) and slide off Remove old batteries and replace with two new AA alkaline batteries (Duracell MN1500 or equivalent). Make sure the polarity of batteries matches the marking on case. Replace battery cover. Note: in order to prolong the life of batteries they should be removed from the hand controller when it is not in use.

Cleaning display lens

The red display lens is made from an acrylic plastic and as such it can be easily scratched. Care must be taken to keep dust and dirt from accumulating on the surface. Periodically blow or brush off the lens using a product such as "Dust Off" a compressed gas duster or a camel hair lens brush. When the lens requires more than that, first dust as above then carefully clean with a product such as Windex and a soft facial tissue.

Lubrication of the Motor/gearbox

Under normal use the lubrication should last for the life of the system. Should you suspect that lubrication is called for contact Ramona Technology for lubricating instructions. If you choose you may return the motor assemblies to the factory and they will be inspected and lubricated for a nominal charge.

Firmware

Upgrading the Firmware and Object Database

Upgrading the controller's firmware or database requires using the included RS-232 cable and placing the controller in the *Auto-Load* mode. This mode is entered during normal power-up when the Hand Controller is not connected. The system will stay in this mode for 10 seconds after power-up at which time the controller will *Auto-Boot* into the current firmware.

Full instructions for downloading new firmware and databases will be placed at ramonatech.com Check this website often as firmware and database upgrades will be posted with a version number to let you know if you have the most current version.

If you do not have access to the Internet, contact Ramona Technology by mail and the update will be mailed to you on a floppy disk or CD-ROM

If you choose you may return the controller to the factory and the system will be updated for a nominal charge.

NOTE: Firmware and Database upgrades require a computer running Microsoft Windows 95 or later.

Chapter 6

Troubleshooting

This will be Future addition if required

Chapter 7

Support

Ramona Technology
17849 Hwy. 67
Ramona, Ca. 92065

Sales Support sales@ramonatech.com
Technical Support support@ramonatech.com

Website http://www.ramonatech.com

Chapter 8

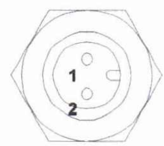
User Connector Information

The following information is supplied for use in interfacing to the goII system. When connecting

equipment not supplied by Ramona Technology make sure you understand what you are doing before proceeding. If you have any doubts contact Ramona Technology. We will be glad to help.

Main Power Connector

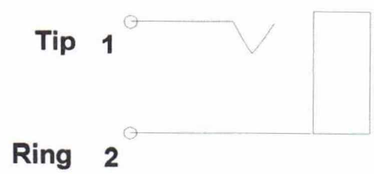
Pin 1 + 12VDC
Pin 2 12 Volt Return



Front Panel View

Focus Motor

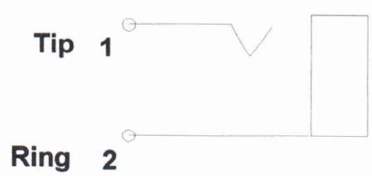
The Focus motor is a differential signal. The motor must be isolated from ground. When the voltage at the TIP is positive with respect to the RING the system will Focus in one direction. When the voltage at the RING is positive with respect to the TIP the system will Focus in the opposite direction.



3.5 mm Phone Jack Schematic

Reticle / Shutter

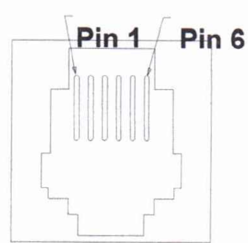
The TIP is always positive with respect to the RING when the function is activated



3.5 mm Phone Jack Schematic

Auto Guider

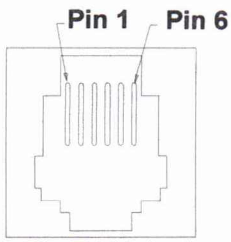
Pin 1 Gnd
Pin 2 Gnd
Pin 3 Guide North
Pin 4 Guide South
Pin 5 Guide East
Pin 6 Guide West



6 Pin RJ11 Jack Front Panel View

RS-232

Pin 1 No connection
Pin 2 Controller Transmit
Pin 3 Controller Receive
Pin 4 Ground
Pin 5 No connection
Pin 6 No connection



6 Pin RJ11 Jack
Front Panel View

Chapter 9

Specifications**

Digital Controller

Tracking:

Sidereal Rate
King Rate
Lunar Rate
Solar Rate
Resolution: 0.28 arc-second/ustep for G11
Resolution: 0.56 arc-second/ustep for G8
Resolution: 0.28 arc-second/ustep for CI 700
PEC

Manual Movement:

Slewing Speed = 3 deg/sec max. (adjustable)
Setting Speed = 10 x Sidereal rate
Guiding Speed = 0.5 Sidereal rate

Data Base:

Over 7000 objects
Updateable over www
Compatible with "TheSky" and "SkyMap"

Display:

2 Line red dimmable LED
Display scrolls under processor control
6 Alpha-numeric characters/line
Character matrix 5x7
Character height 0.7 inches

Focus Motor Driver:

Focus in/out
Focus rate is adjustable
Will operate 12-volt motors with a current requirement of 0.05 amp max

Reticle Intensity/ Shutter Driver:

Adjustable
Will provide up to 10 Vdc at 0.05 amp max

AutoGuider Input:

Accepts 4 dry contact inputs

Interfaces:

RA Motor: RJ45 Connector
DEC Motor: RJ45 Connector
Focus Motor: 1/8 mono phone jack
Wiring Tip
Sleeve

Specifications (cont.)

Interfaces (cont.):

Reticle/ Shutter: 1/8 mono phone jack
Wiring: Tip
Sleeve
Auto Guider RJ11 6x6 SBIG Compatible
Wiring: Pin1 Common
Pin2 Common
Pin3 North Switch
Pin4 South Switch
Pin5 East Switch
Pin6 West Switch

Hand Controller RJ11 6x6
RS232 RJ11 6x6

Power Requirements:

12 VDC @ 2 amps (average current ~0.5 amp)
Power Connector Conxall

Real Time Clock Battery:

Battery Life ~5 years
Battery: 3v Lithium Coin 23mm Type: CR2330

Hand Contoroller

10 key adjustable brightness lighted keypad
North, South, East, West for direction
Slew, Set for speed
Enter, Mode, Up, Down for database and menu selection
Dimensions: 5x2.7x1.25
Cable Length: 10 ft

Hand Controller (Wireless Option)

Operational Distance from Controller: 10-ft max.
Standby mode: blinks lighted keys for 2 hours after 10 minutes
Of inactivity for ease of finding hand controller in the dark
Any key exits standby mode
Battery: AA Alkaline 2 each (Duracell MN1500 or equivalent)
Battery Life: approximately 200 Hours

Stepper Motor / Gearbox Losmandy Mount

Gear Ratio: 4:1
Output Shaft Dia.: 0.187
Shaft Length: 0.500 from mounting surface of gearbox
Dimensions: 2.60 x 3.00 x2.5 (excluding shaft)
Motor full step: 1.8 degrees
Motor Voltage: 3.7v
Motor Current: 1.2 amp
Motor Holding torque: 44 in-oz
Motor Drive: bipolar, mico-stepped in tracking modes
Cable Length: 16 inches RA, 32 inches DEC

Stepper Motor / Gearbox Celestron CI-700 Mount

Gear Ratio: 8:1
Output Gear 64 pitch 80 tooth SS
Dimensions: 2.00 x2.50 x 3.40)
Motor full step: 1.8 degrees
Motor Voltage: 3.7v
Motor Current: 1.2 amp
Motor Holding torque: 44 in-oz
Motor Drive: bipolar, mico-stepped in tracking modes
Cable Length: 16 inches RA, 32 inches DEC

** Specifications subject to change without notice.

Chapter 10

Glossary

CATLOG	Catalog
DEC	Declination Angle
DISBRI	Display Brightness
FIRMWARE	
FOCSPD	Focus Speed
KGRAT	King Rate
LAT	Latitude
LED	Light Emitting Diode
LONG	Longitude
LUNRAT	Lunar Rate
MV DEC	Move to Declination angle
MV RA	Move to Right Assencion angle
PC IBM	Compatable Personal Computer
PE	Periodic Error
PEC	Periodic Error Correction
RA	Right Assencion Angle
RETBRI	Reticle Brightness
RF	Radio Frequency
RTC	Real Time Clock
SCRSPD	Display Scroll Speed
SIDRAT	Siderial Rate
SLWSPD	Slew Speed
SOLRAT	Solar Rate
UT-OFF	Universal Time Offset

Chapter 11

Warranty

go II

WARRANTY

Ramona Technology warrants to the original user that the system will be free from design and manufacturing defects for 1 year from purchase.

This warranty does not apply to any unit (i) damaged during shipping or installation, (ii) unless that it is installed strictly in accordance with the instructions in this manual, (iii) subjected to accident, abuse or misuse

Our liability under this warranty is limited to repair or replacement of the defective component. The defective component will be shipped, prepaid, to Ramona Technologies for repair or replacement. We shall not be liable for any labor, or other installation costs, indirect or consequential damage or any other damages in connection with this system

THE FOREGOING CONSTITUTES OUR EXCLUSEVE OBLIGATION, AND WE MAKE NO EXPRESS OR IMPLIED WARRANTIES OR ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE WHATSOEVER, EXCEPT AS STATED ABOVE

Prior to returning any merchandise the customer / owner shall obtain an RMA number from Ramona Technology. The customer / owner is required to return said defective merchandise, freight prepaid to Ramona Technology 17849 Highway 67, Ramona California 92065

SERIAL NUMBERS

Digital Controller .... Hand Controller.......................

RA Motor Assy .... DEC Motor Assy ....

RAMONA TECHNOLOGY
17849 HIGHWAY 67
RAMONA, CA 92065
WWW.RAMONATECH.COM